Space Weather Technical Forecast

Issued on Wednesday, 02 March 2022 at 12:55 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1 Minor Geomagnetic Storms days 2-4. Increasing Slight Chance of R1 Minor Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low in the last 24 hours, with two C-class flares recorded at GOES 16. There are currently five numbered sunspot regions and one unnumbered region on the visible disc. AR2954 and 2955 remain single stable, mature Hsx/Alpha spots in the northwest quadrant. AR2956 (Axx/Alpha) just west of centre disc in the northern hemisphere, continues to weaken. AR2857 in the southeast quadrant is the source of both the short period and long period C-class flares this morning UTC. It has shown growth and consolidation in its lead/trailer portions, alongside development of its intermediate spots, therefore now classified Dao/Beta. AR2958 in the northeast quadrant has shown decay in recent imagery, now classified Cro/Beta. The NEW region to the west of AR2947 is a simple Bxo/Beta.

No Earth directed CMEs (coronal mass ejections) have been observed.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, was in the range 460-550km/s, with a decreasing trend. The solar wind density was generally at around average of slightly above average levels. The Total IMF (Bt) was weak 2-5nT, with the north-south component (Bz) ranging between +4 and -3nT. The phi angle was positive (away from the sun). Geomagnetic activity was Quiet (Kp 1 to 2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured at GOES 16 was at Background levels. The high energy electron flux (greater than 2 MeV) has been at Normal Background levels. The corresponding 24-hour integrated electron fluence was well below the Active (1e8 integrated pfu) threshold with a recent slow rising trend. The 02/0000 UTC observation was 2.66e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low, with a Slight Chance of isolated M-class flares. Chances may continue to increase later in the period as the potential returning regions transit around the eastern limb.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast. Geomagnetic activity is expected to be Quiet with a chance of Unsettled and a Slight Chance of isolated Active intervals. Late on day 2 or on days 3 and 4 (03-05 March), coronal hole 61 will become geoeffective, bringing Unsettled to Active geomagnetic activity with a chance of G1/Minor Storm intervals, due to its negative polarity and the proximity to the spring equinox.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels. High energy electron flux is likely to follow an erratic trend, with only a slight chance of exceeding the high (1e3 pfu) threshold during diurnal peaks as solar wind speeds ease into day 2. Electron fluence is also forecast to follow an erratic trend, but is unlikely to achieve the Active (1e8 integrated pfu) threshold before the suppressing effects from coronal 61 arrive from late on Day 2.

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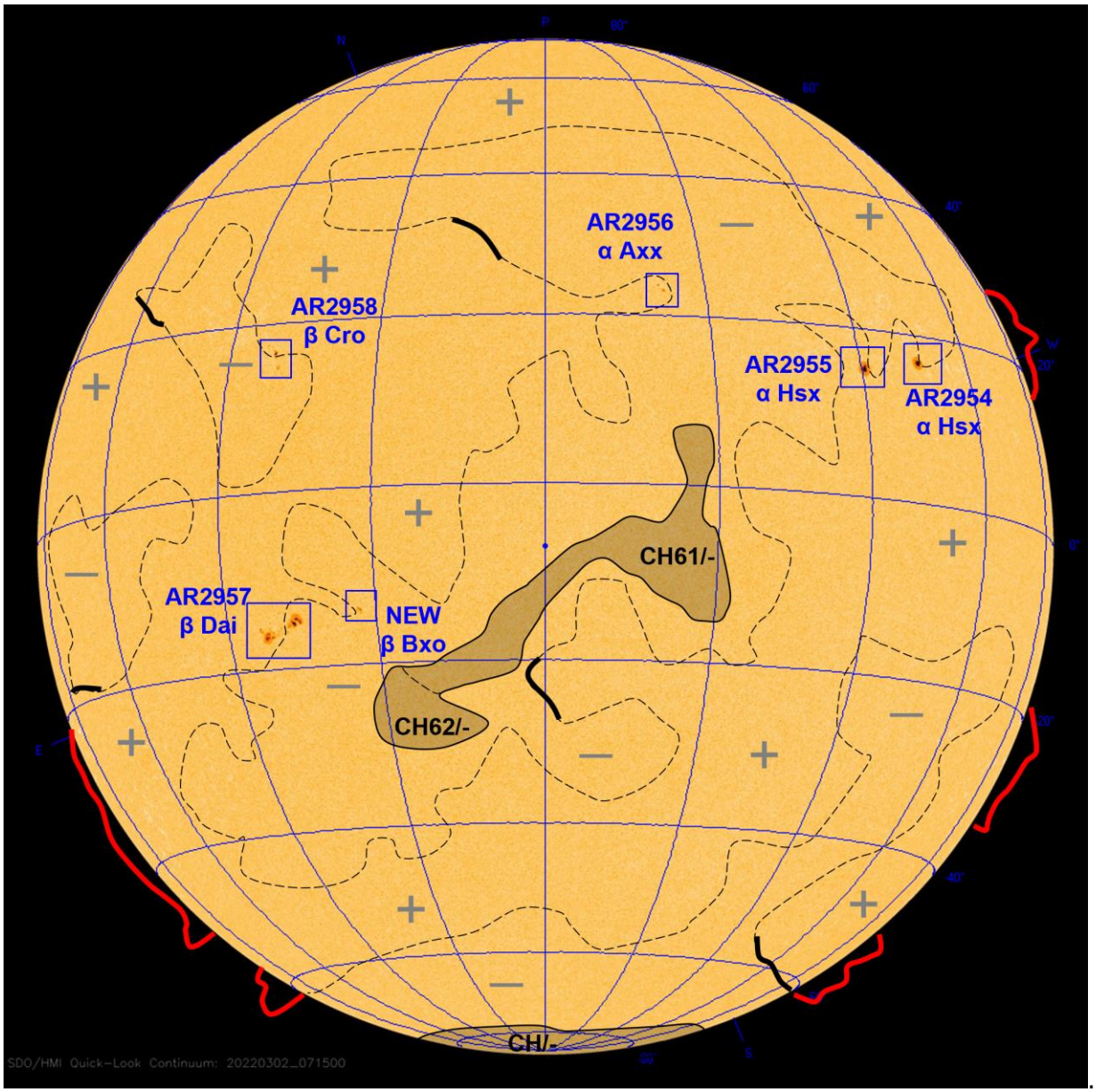
Figure 1. Solar Analysis Valid 02/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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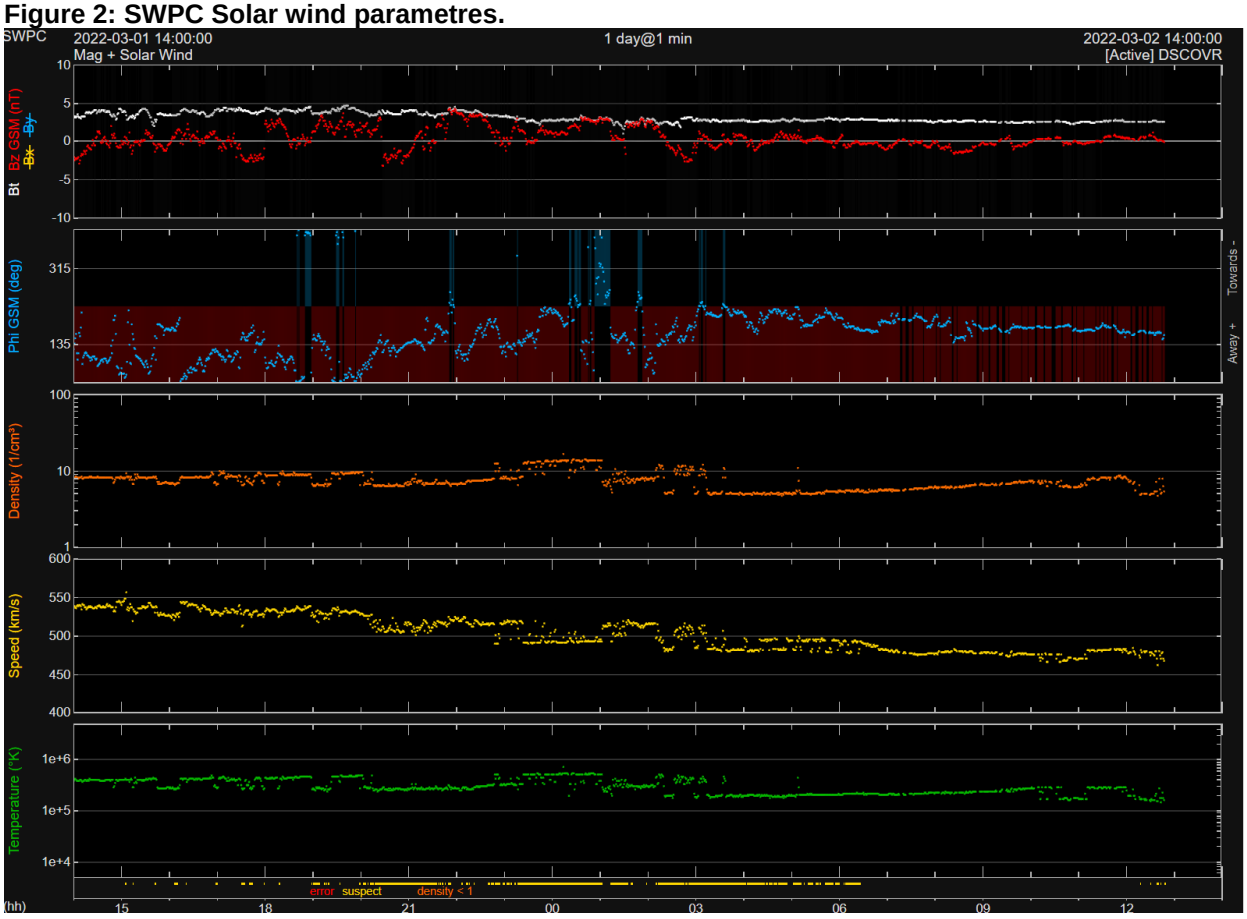
Geomagnetic Storms:

There are currently no Earth-directed CMEs that feature in the forecast.

Solar wind speeds are currently slightly elevated due to coronal holes 58/60. These are both positive and are showing overal Quiet geomagnetic activity at present. This is expected to continue as solar wind speeds continue decreasing during day 1 and day 2 (02 and 03 March). Coronal hole 61, which is negative polarity, may become geoeffective any time from late on day 2 (03 March), if solar wind speeds reach 550 km/s upon arrival, this continuing into day 3 and possibly day 4 (04 and 05 March).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	40	40	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SWPC Solar wind parametres.



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Radio Blackouts - X-Ray Flares:

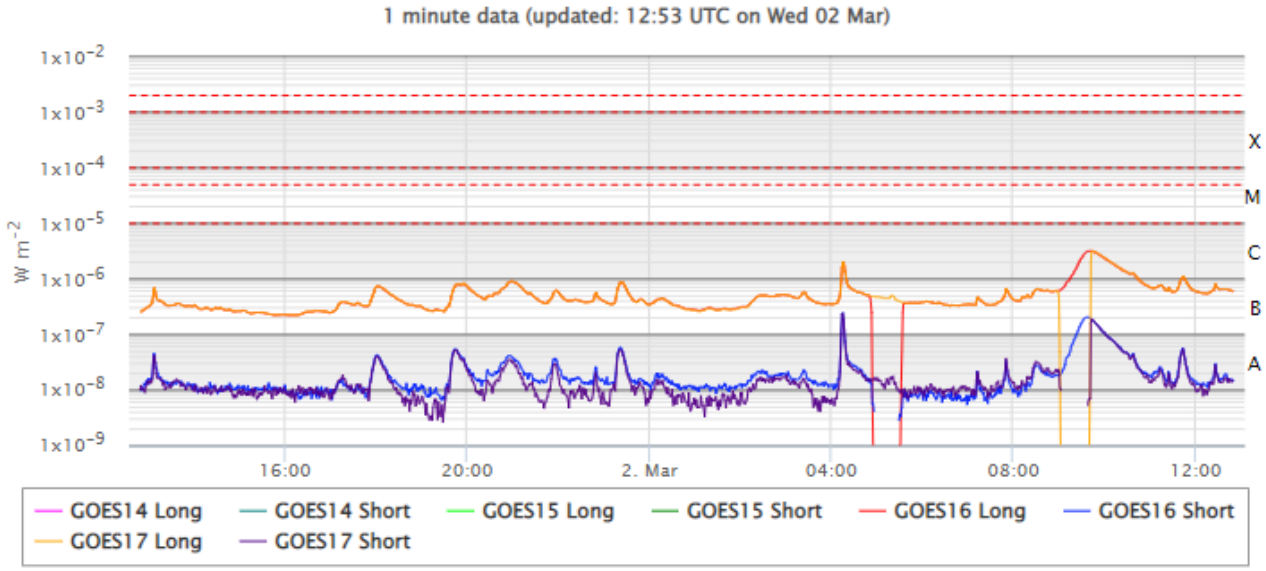
There are currently 6 active regions on the visible disk. The most noteworthy is AR2957 in the southeast quadrant, currently classified as a Dai/Beta. Two C-class flares originated from this region in recent hours, one of which was a long period flare, but with no observed ejecta in current imagery.

Two further bright regions evident on STEREO-A imagery are expected to rotate around the east limb during the next few days. Foremost of these appears to be a large region possibly corresponding to Ex-2941 and Ex-2947 in the northern solar hemisphere, as well as an apparently smaller region likely related to Ex-2945 in the south, currently just beyond the southeast limb.

Solar activity is expected to be Low, but with a small chance of isolated M-class flares. Chances increase slightly later in the period due to the potential returning regions mentioned above.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	25	25	25
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 3: GOES16 xray trace



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is at background levels, and expected to remain at this level throughout.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) is currently exhibiting a low trend within Background levels, but should respond upwards during days 1 and 2 (02 and 03 March) as we exist from the high speed stream of CH60. From late in day 2 (03 March) onward, the HSS from CH61 is expected to arrive, likely further suppressing the Van Allen belts and the electron count in the short-term. A rising trend is then expected once again toward the end of the forecast period but with a low risk that solar wind speeds will have relaxed sufficiently to surpass the Active (1e8 integrated pfu) threshold.

The relevant four-day period from last rotation suffered from CME influences, so REFM guidance and persistence in general is expected to offer less of a steer than would usually be the case, meaning that confidence is lower than usual.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	20	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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